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Implications of Debunking the "Critical Positivity Ratio" for Humanistic Psychology

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Published in:
Journal of Humanistic Psychology

DOI:
[10.1177/0022167818762227](https://doi.org/10.1177/0022167818762227)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2018

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Friedman, H. L., & Brown, N. J. L. (2018). Implications of Debunking the "Critical Positivity Ratio" for Humanistic Psychology: Introduction to Special Issue. *Journal of Humanistic Psychology*, 58(3), 239-261. <https://doi.org/10.1177/0022167818762227>

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Implications of Debunking the “Critical Positivity Ratio” for Humanistic Psychology: Introduction to Special Issue

Journal of Humanistic Psychology

2018, Vol. 58(3) 239–261

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DOI: 10.1177/0022167818762227

journals.sagepub.com/home/jhp



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Abstract

An extraordinary claim was made by one of the leading researchers within positive psychology, namely, there is a universal-invariant ratio between positive to negative emotions that serves as a unique tipping point between flourishing and languishing in individuals, marriages, organizations, and other human systems across all cultures and times. Known as the “critical positivity ratio,” this finding was supposedly derived from the famous Lorenz equation in physics by using the mathematics of nonlinear dynamic systems, and was defined precisely as “2.9013.” This exact number was widely touted as a great discovery by many leaders of positive psychology, had tremendous impact in various applied areas of psychology, and, more broadly, and was extensively cited in both the scientific literature and in the global popular media. However, this finding has been demonstrated to be bogus. Since its advent as a relatively new subdiscipline, positive psychology has claimed superiority to its precursor, the subdiscipline of humanistic psychology, in terms of supposedly both using more rigorous science and avoiding popularizing nonsense. The debunking of the critical positivity ratio demonstrates that positive psychology did not live up to

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these claims, and this has important implications, which are discussed in terms of “romantic scientism” and “voodoo science.” In addition, articles in the special issue on the “Implications of Debunking the ‘Critical Positivity Ratio’ for Humanistic Psychology” are introduced, as they also delve into these concerns.

Keywords

2.9013, critical positivity ratio, debunking, humanistic psychology, positive psychology, romantic scientism, voodoo science

Positive psychology emerged from humanistic psychology by promising to be more scientific than its predecessor, which its proponents soundly criticized for its lack of scientific rigor. The dividing line between the two subdisciplines of psychology was clearly drawn when Seligman and Csikszentmihalyi (2000) extolled the alleged scientific advantages of positive psychology over humanistic psychology in their founding manifesto published in the *American Psychologist*, as follows:

Unfortunately, humanistic psychology did not attract much of a cumulative empirical base, and it spawned myriad therapeutic self-help movements. In some of its incarnations, it emphasized the self and encouraged a self-centeredness that played down concerns for collective well-being. Further debate will determine whether this came about because Maslow and Rogers were ahead of their time, because these flaws were inherent in their original vision, or because of overly enthusiastic followers. However, one legacy of the humanism of the 1960s is prominently displayed in any large bookstore: The “psychology” section contains at least 10 shelves on crystal healing, aromatherapy, and reaching the inner child for every shelf of books that tries to uphold some scholarly standard.

Recently, however, positive psychology has had reasons to regret taking such a militant stance, as some of its most cherished findings have been shown to lack the scientific rigor on which it had staked its initial legitimacy as a new subdiscipline. Perhaps the most infamous of these is its claim to having found the “critical positivity ratio” (Fredrickson & Losada, 2005). In this claim, a highly specific number, 2.9013, was specified as being a universal-invariant “tipping point” (a term that has become widely popular, as in Gladwell, 2000), that distinguishes between “flourishing” and “languishing” across all sorts of human systems, including across cultures and time. This number was supposedly based on the famous Lorenz equations from the discipline of physics, and

derived using the mathematics of nonlinear dynamic systems, which lent it great credence by association with these respected disciplines. It also was supported by a very small number of empirical studies of dubious worth. The ratio is computed by simply dividing the number of so-called positive to negative emotions, regardless of how those might be operationalized across various settings and times. The outrageous claim was made that a ratio equaling or exceeding the critical number of 2.9013 results in flourishing, at least supposedly up to another critical point when it is speculated to switch directions—but that is another matter we do not address. This critical positivity ratio has been applied to businesses (e.g., Rego, Sousa, Marques, & Cunha, 2012), education (e.g., Norrish, Williams, O'Connor, & Robinson, 2013), health care systems (e.g., Gallan, Jarvis, Brown, & Bitner, 2013), marriages (e.g., Fincham & Beach, 2010), and many other human systems, including to individuals' mental health (e.g., Faulk, Gloria, & Steinhardt, 2013). Businesses that demonstrate or exceed a ratio of 2.9013 positive to negative communications supposedly will have satisfied employees whose work will be successful, but businesses that fall below this ratio will be unproductive. Educational systems that demonstrate or exceed 2.9013 positive to negative communications between teachers and students supposedly will have successful learning outcomes, but those that fall below this ratio will lead to academic failures. Health care systems that demonstrate or exceed 2.9013 positive to negative communications supposedly will have healthy patients, but those that fall below this ratio will worsen their patients' illnesses. Marriages that demonstrate or exceed 2.9013 positive to negative communications supposedly will have contented partners with lasting relationships, but those that fall below this ratio will end in divorce. Individuals who demonstrate 2.9013 positive to negative self-talk will be happy, but those who fall below this ratio will be unhappy and even clinically depressed, and so forth.

The critical positivity ratio was widely touted as being the gem of positive psychology, and it went beyond an abstract claim into widespread applications. It spawned various industries, such as marriage counseling and organizational consulting efforts aimed at getting people's interactions over this so-claimed 2.9013 tipping point into flourishing (and, hence, outside of languishing) terrain. School intervention programs were designed to ensure that students received 2.9013 or more positive than negative communications from their teachers, as were health care systems relating to interactions between caregivers and patients. Business training courses were built around that same principle. Even the largest-ever applied social science research¹ program ever, the Comprehensive Soldier Fitness program that trained literally every member of the U.S. Army, based its scientific legitimacy on this alleged finding (Jonas et al., 2010). Fredrickson and Losada's (2005) article

on the discovery of the critical positivity ratio received more than 2,000 citations in the scholarly literature (retrieved from Google Scholar, April 15, 2017), and this alleged finding was also covered in a best-selling popular book (Fredrickson, 2009) that garnered the strongest praise from many of the most well-known positive psychologists. On the book's website, both Csikszentmihalyi and Seligman (see <https://www.positivityratio.com/praise.php>), the co-founders of positive psychology, enthusiastically endorsed it. Seligman wrote,

The first time I heard Barb Fredrickson speak, the famous psychologist sitting next to me said, "That's the real thing!" This book, like Barb, is the "Real Thing": It's the perfect blend of sound science and wise advice on how to become happier. Barbara Fredrickson is the genius of the positive psychology movement.

Csikszentmihalyi similarly wrote,

Written by one of the most influential contributors to this new perspective in science, *Positivity* provides a wonderful synthesis of what positive psychology has accomplished in the first decade of its existence. It is full of deep insights about human behavior, as well as useful suggestions for how to apply them in everyday life.

A parade of other stars from the positive psychology movement lined up on this website to genuflect at this remarkable 2.9013 finding and extoll the importance of this best-selling book.

Alas, however, we (along with our colleague, Alan Sokal) demonstrated that the critical positivity ratio is more than just problematic—it is nonsense (Brown, Sokal, & Friedman, 2013, 2014a). When findings in psychology are challenged, it often results in bitter debate over interpreting words and data, but this huge claim about the universal-invariant nature of the critical positivity ratio was based on mathematics—and in mathematics there are right and wrong answers that can be proven and disproven, as opposed to merely argued over, as psychologists are all too often used to doing when interpreting empirical findings.

The problem is that the basis of the critical positivity ratio was mathematically misapplied, and hence is invalid (Brown et al., 2013). After much quibbling, including serious battles to even get our 2013 paper published, as it challenged a highly lauded finding, the flawed mathematics was finally acknowledged through Fredrickson and Losada's (2013) retraction of the specific number and its underlying mathematics, withdrawing their remarkable claim for 2.9013 as being a universal-invariant ratio.

Fredrickson (2013b), however, continued to assert that there is ample empirical evidence for a tipping point somewhere around “3,” but we also showed that this claim is invalid (Brown et al., 2014a). Nevertheless, Fredrickson and many others in the positive psychology movement to this day do not acknowledge that their softened claim of an optimum ratio of 3 positive to 1 negative emotions, presumably still universal and invariant, is nonsense, although this claim is no longer based on the withdrawn mathematics but, rather, on their (and others’) so-called empirical findings from an assortment of studies using widely varying methods.

It can easily be seen that even this softened claim is based on flawed reasoning, because it implicitly requires all experiences of emotion to have the same magnitude and duration to be comparable, which is absurd. A moment’s thought will show how impossible it is to actually measure a person’s experience of positive emotions on this basis. If someone laughs at a joke on TV, eats an ice-cream, sees their dog get run over, and watches a nice sunset, are they at a 3 to 1 ratio of positive to negative emotions and flourishing? And so it is with any comparison of emotions, as who can provide a value-free metric on which to draw any comparison in a universal–invariant way?

We discussed this problem in some depth elsewhere when looking at other approaches to emotions as conceptualized within positive psychology (Friedman & Brown, 2014). Sometimes such claims reach the level of extreme absurdity, as when Larsen (2009) decided that Fredrickson and Losada’s (2005) figure of 2.9013 could be rounded-up just a little further to a very important number in mathematics by suggesting this alleged tipping point should be viewed as the mathematical constant π . Arguing that there is a critical positivity ratio of 2.9013 based on flawed mathematics is bad enough, but arguing that it really is 3.14 without any justification is beyond our rational understanding.

Understanding Why Belief in the Critical Positivity Ratio Persists

Despite being debunked, the belief in the critical positivity ratio persists. Within separate chapters in the same book (Joseph, 2015), two differing conclusions about debunking the critical positivity ratio are drawn. Lewis (2015) wrote, “The statistical analysis on which this assertion is made has been questioned . . . and the debate rages as to the status of the finding” (p. 331), while Robbins (2015) wrote, “Simple formulations of well-being that may be seductive as abstract conceptions of happiness but are false and misleading, such as the critical positivity ratio” (p. 38). This divide represents the ongoing controversy between those who are holding onto the false belief that

somewhere there is a critical positivity ratio and those who accept the debunking and its implications. Even though the mathematics for establishing 2.9013 as a tipping point has been withdrawn by those who authored this extraordinary claim, nevertheless belief in it lingers among many positive psychology adherents.

Perhaps this is partly due to the fact that, although she withdrew her claim for the existence of a universal-invariant number for the critical positivity ratio, Fredrickson (2013b) continued to claim there is empirical evidence for a tipping point somewhere around the ratio of 3 to 1. In our response to her continued claim of a ratio of around 3 to 1 existing, we showed that there was no empirical evidence whatsoever for any such tipping point, including the rounded-off number 3 or any other number (Brown et al., 2014a), let alone π as Larsen (2009) had proposed. We note that our rebuttal to her empirical claim was never refuted or even challenged.

Wishful Thinking, Romantic Scientism, and Voodoo Science

We included the term “wishful thinking” in the title of two of our articles on this topic (Brown et al., 2013, 2014a), and also discussed the implications of this in a summary paper (Brown, Sokal, & Friedman, 2014b) in which we described the critical positivity ratio as an example of “romantic scientism.” Simply put, the claim for the existence of a universal-invariant number comparing positive to negative emotions related to flourishing and languishing is simultaneously both thoroughly romantic, appealing to some naïve wish for complex human experience and behavior to be reduced to a simple formula (especially when rounded-up to π as Larsen, 2009, suggested), and thoroughly scientific, appealing to the mathematics of nonlinear dynamic systems in a way that few psychologists can understand and that was completely misapplied. Hence, the errors made can be seen as a combination of scientism and romanticism that we call romantic scientism.

As the debunking of the critical positivity ratio was widely covered by the press (e.g., Anthony, 2014), it seems reasonable to expect this claim would have simply disappeared as part of science’s long history of discarded nonsense. Yet acceptance of the validity of the critical positivity ratio persists, as there continue to be numerous citations that either ignore, or minimize the implications of, our debunking of this claim.

Why should this be? One way to understand this relates to so-called “voodoo science”² (Charlton, 2008) and its resulting “zombie articles” (Neher, 2011), something one of us used previously to describe the continued citations giving credence to the critical positivity ratio (Friedman, 2015b). Voodoo science is used to depict various scientific problems, and

bears some similarities to what has sometimes been called “cargo-cult science,” “junk science,” and simply pseudoscience. Such problematically bad science stems from a variety of possible causes, including self-deception (as scientists often are oblivious to their biases) and, at the extreme, intentional fraud. Scientific findings are supposedly cumulative, such that research claims shown to be wrong should ideally be replaced by revised claims. However, this does not always work quickly, so even after being debunked, flawed work based on voodoo science can continue to spawn publications that cite the debunked findings like zombies that still walk the earth, even though long dead.

Motive for These Extraordinary Claims

Although we do not want to speculate about any motive for making the extraordinary claims of Fredrickson and Losada (2005) regarding the critical positivity ratio, others have done so. For example, Prichard (2015) commented on the debunking of the ratio, as follows:

While there is no reason to believe the authors intentionally misused the math, it became quite apparent that they had no idea what they were doing and neither did the peer reviewers or the editors at *American Psychologist*. Unfortunately . . . the rate at which the Fredrickson and Losada paper continues to be cited far outpaces the rate at which the rebuttal has been cited. (p. 48)

Similarly, Koepsell (2016) discussed that our article resulted in an uncontested debunking, such that “the ratio is eviscerated, and even Fredrickson has now conceded this point,” but she is “still putting a positive spin on things and clinging to her thesis, despite the lack of solid evidence” (p. 19), concluding that Fredrickson and Losada may have fooled themselves, even if this did not reach the level to be seen as actual fraud.

The Tension Between Growing Acceptance and Continued Resistance

Fortunately, the beginnings of some acceptance of our debunking the critical positivity ratio is slowly appearing. In addition, there is now even some empirical work demonstrating the absurdity of the claim for this allegedly universal-invariant number. For example, Shrira, Bodner, and Palgi (2016) showed that the observed ratio changes depending on research participants’ ages and the specific measurement approaches used, so the ratio is clearly not empirically invariant around 3, as it varies based on at least these two factors.

Of course, it varies on many other factors, and again that there is no consensual metric to make emotions comparable in any simplistic way, so the very notion on a universal invariant number is absurd.

However, after receiving such a strong “halo effect” vested in its claimed scientific legitimacy from its supposed connection to physics and use of non-linear dynamic systems from mathematics, the critical positivity ratio still refuses to die, perhaps exhibiting the opposite of a halo (i.e., a “devil-horned”) effect. Its staying power, despite compelling contradictory evidence, is congruent with the underlying cultural belief about applying science to the complexity of individuals and human systems. The widespread belief that such complexity can be reduced to a simple universal-invariant law that can be quantified precisely reveals a cultural trap prevalent within much of mainstream science (see Glover & Friedman, 2015), and especially so within psychology’s subdisciplinary culture (Friedman & Glover, 2016). This relates to misunderstanding what good science can actually deliver in this regard, as opposed to what voodoo science promises through wishful thinking, but can never actually deliver. The fact that many researchers and practitioners continue to cite and use the critical positivity ratio demonstrates that this point is often missed, as our debunking was not merely about finding some simple errors in calculation, but rather demonstrated that the attempt to find a universal value to explain such complexity was misguided from start to finish. That such voodoo science continues to influence the literature in psychology and other scientific disciplines, as well as to influence practices supposedly based on science, is disquieting.

Alas, zombie papers continue to appear that argue for an optimum tipping point in the form of a critical positivity ratio, showing how hard it is to kill the spawn of voodoo science. Indeed, reading a number of recent discussions of the critical positivity ratio in the literature, it sometimes feels to us as if some collective decision has been taken to portray the fundamental problems in Fredrickson and Losada’s (2005) article as merely minor mathematical inaccuracies, at most. Lewis (2015) stated “the statistical analysis on which this assertion is made has been questioned (Brown et al., 2013) and the debate rages as to the status of the finding” (p. 331), while Boyatzis, Rochford, and Taylor (2015) similarly stated that “a recent critique of Fredrickson and Losada’s ratio (Brown et al., 2013) has raised a fresh debate as to the relative strength of these two affective states” (n.p.), and Cross and Pressman (2017) stated only that “the advanced math behind this ratio has recently come under scrutiny” (p. 85). However, this is not a matter of continued debate or simply coming under scrutiny, as the outrageous claim for a critical positivity ratio has been shown to be completely wrong, both mathematically and empirically.

As a result of confusion, and possibly obfuscation, about this debunking, the scientific literature continues to include abundant numbers of papers referencing a tipping point around 3, despite the utter lack of evidence for any such claim. For example, Terni (2015) stated, “Fredrickson (2009) found that a ratio of positive to negative emotions of 3 to 1 or more leads to flourishing, a finding that still holds despite recent criticism” (p. 12), while Coulombe, Jutras, Labbé, and Jutras (2016) appeared to imply that our only contribution had been to correct the possibility that, in cases with just a small amount of negative emotions, one’s positivity ratio might become invalid due to needing to divide by zero, but otherwise the critical positivity ratio still holds.

Recanting the Withdrawal of the Mathematics Adds to the Cacophony

Even worse, Losada, who coauthored the correction that withdrew the mathematical modeling component of the claim for a critical positivity ratio (Fredrickson & Losada, 2013), has now changed his mind about his withdrawal of the mathematics. Indeed, in an article posted on his consulting company’s website (Losada, 2014), he continued to argue in support of the critical positivity ratio, and his company’s logo on that same website (<http://losadalineconsulting.net/>) still depicts the butterfly-shaped Lorenz attractor that became an icon of the critical positivity ratio within the popular media. In his 2014 recantation of his 2013 withdrawal and his reaffirmation of its original mathematics, Losada invoked the names of many luminaries as supporting his original claim for the existence of *2.9013* as a universal-invariant tipping point, including mentioning Artur Avila, a recent winner of the prestigious Fields Medal (the equivalent of the Nobel Prize in mathematics), who is also from Brazil where Losada’s company is located. We contacted Avila, who stated (personal communication, August 25, 2015):

I was never contacted by Losada, and in fact this is the first time I hear of him. I browsed the text you sent me and he seems to have no idea about what I actually work on. I have not contributed to the theory of Lorenz attractor, and I don’t see how my work on universality would apply specifically to this kind of dynamics. But in any case, it seems to me that he is just name dropping without any understanding of what the mathematical notions he talks about actually mean for mathematicians.

We wonder whether, in light of the fact that one of its coauthors clearly no longer believes in what he wrote in his withdrawal of the mathematics underlying the critical positivity ratio, Fredrickson and Losada’s (2013) correction might not now be in need of a correction of its own.

Implications for Similar Ratios: The Gottman (2015) Ratio

Losada, in redefending his mathematical claims after he had withdrawn them, also invoked the name of Gottman (2015) as one of his still-loyal supporters, and Gottman is quite well-known for having widely proclaimed his own controversial tipping point of 5 to 1 positive to negative interactions as being instrumental to the course of marriages, particularly in delineating and predicting happy marriages from those ending in divorce. Boyatzis et al. (2015) discussed a number of other positivity ratios found in the scientific literature, concluding that the controversy about the Fredrickson and Losada (2005) critical positivity ratio makes that ratio suspect, but that the validity of the Gottman 5-to-1 ratio is not in any question. However, that is not true as Shapiro (2015), among many others, provided a cogent criticism of Gottman's (2015) mathematical modeling for first obtaining data and then, after the fact, fitting these data to preset variables without first independently replicating these findings with new data. Shapiro also cited our work as having "demonstrated that such modeling is often misapplied and produces errors in conclusions" (n.p.).

Gottman (personal communication to Friedman, April 30, 2015) wrote,

I never understood the math in the Fredrickson and Losada paper and wrote to Marcial [Losada] for more explanation and never got a reply. I do predict that eventually it will be possible to find that this positive-to-negative ratio will turn out to be the eigenvalue of some nonlinear differential equation describing general well-being, including happily married couples' interactions. However, so far in our work the 5-to-1 pos-neg ratio during conflict discussions for stable happily married heterosexual couples is only an empirical result.

This is the big difference between the claim of Gottman and the original claim of Fredrickson and Losada, namely, Gottman only based his ratio on data and never claimed a universal-invariant number derived from mathematics. It seems Fredrickson and Losada (2013) retreated to this less outrageous position in their withdrawal of the mathematics, at least until Losada (2014) reneged on his withdrawal, although his disavowing was not in a peer-reviewed publication but only on his commercial website in which he has financial stake in continuing the myth of the critical positivity ratio.

Regarding the softer claim for a tipping point that is less precise than 2.9013, the same criticisms we have leveled against the empirical argument for Fredrickson's 3 to 1 rendition of her ratio apply to Gottman's 5 to 1 ratio as well, namely, how can one evaluate emotions, positive or negative, in any commensurate way to derive a meaningful ratio? In a marriage, can we compare receiving any number of superficial compliments (i.e., either 3 using

Fredrickson's or 5 using Gottman's approach) with 1 physically abusive, drunken episode to get a good balance leading to a happy relationship? Consequently, we think all ratios of this ilk are fatally flawed, but some are more flawed than others, as the critical positivity ratio with its strong claim for a 2.9013 tipping point is astoundingly flawed.

Seligman Chimes In

Seligman, as one of the founders of the positive psychology movement, lectured extensively about the importance of the critical positivity ratio over many years, and even misstated on multiple occasions captured throughout the Internet that the alleged finding of 2.9013 was initially based on studies within 60 organizations when, in fact, it was based only on studies on 60 teams within just one organization. He has privately acknowledged this exaggeration as a mistake, which he tentatively attributed to his misremembering a crucial fact and not fact checking his claim (personal communication to Friedman on September 5, 2013). However, despite promoting the critical positivity ratio as the gem of positive psychology in speeches all over the world, after its debunking he claimed,

Has it escaped your notice that none (zero) of the papers that I know who followed up Fredrickson took the math or the derivation or the exact number of the ratio seriously? And that none that I know of conceived of the ratio as "critical?" What the literature took seriously and still stands is that some ratio (differing perhaps by context) is likely optimal for some particular functioning. (Personal communication to Friedman on September 5, 2013)

Later, after being challenged by Friedman on this assertion, as clearly many in positive psychology and more broadly in psychology and other disciplines did take this claim quite seriously, Seligman wrote, "But if you think I ever endorsed a 'critical' or 'universal' ratio as opposed to praising Fredrickson's work generally, you are simply wrong" (personal communication to Friedman on September 26, 2013). That same day, Friedman responded: "It does seem clear to me that you 'endorsed a critical or universal' ratio of 3-1 when you used that exact ratio in a classroom intervention and cited Fredrickson and Losada's (2005) paper to support its use" (in Seligman, Ernst, Gillham, Reivich, & Linkins, 2009). This illustrates how one leader in the positive psychology movement has tried to come to terms with the debunking of the critical positivity ratio, and that he still holds on to the unfounded belief that some optimal emotional ratio will eventually be found, despite the incommensurate nature of emotions.

Romantic Scientism as an Endemic Problem Within Positive Psychology

Pennycook, Cheyne, Barr, Koehler, and Fugelsang (2015) wrote about what they called “pseudo-profound bullshit.” This genre of scholarly manure was characterized as obfuscating with impenetrably vague verbiage often linked with scientific allusions that made it seem profound. In a similar vein, one of us has been writing for a long while on reconciling the tension between “scientism” and “romanticism” in doing legitimately good science (Franco, Friedman, & Arons, 2008; Friedman, 2002a, 2002b, 2005, 2008, 2015a). Romanticism involves among other things naively accepting all sorts of dubious things that seem pleasing, while scientism involves among other things naively accepting all sorts of dubious things that seem scientific but are not. We have placed these terms together to address approaches that seem both pleasing and scientific by invoking the new term, romantic scientism, to describe a combination that involves the worst of both, which is how we described the fiasco that is the critical positivity ratio (Brown et al., 2014a).

A number of unnamed adherents to positive psychology challenged us by claiming that Fredrickson’s work on the critical positivity ratio was just an anomaly. As the avowed best-of-the-best researcher within positive psychology, they claimed her other work lives up to her top-notch reputation, so we turned our attention to some of that other work. In a recent high-profile paper in which she and her coauthors claimed that adhering to eudaimonic (i.e., altruistic-based) rather than hedonic (i.e., pleasure-based) happiness led to more favorable patterns of gene expression,³ we found that her conclusion again was more than problematic (Brown, MacDonald, Samanta, Friedman, & Coyne, 2014), and when she and her coauthors published a follow-up paper on the same topic that doubled-down on her previous claim, that too we found to be severely flawed (Brown, MacDonald, Samanta, Friedman, & Coyne, 2016); other authors have also pointed out very substantial problems with this work (Nickerson, 2017a; Walker, 2016). Similarly, in another recent high-profile paper we examined closely, Fredrickson and her coauthors claimed that practicing loving-kindness meditation led to better physiological outcomes (as indexed by vagal nerve tone), and yet again we found that conclusion untenable (Heathers, Brown, Coyne, & Friedman, 2015). What could be more romantically pleasing than making scientific claims that altruism leads to more favorable gene expression, loving kindness meditation leads to better physical health, and that there is a universal-invariant ratio that can lead to flourishing if only people would just increase their ratio of positivity to negativity above the 2.9013 tipping point? And surely, nothing bolsters such romantic claims better than alleged scientific facts that claim to

be grounded in the discipline of mathematics through using nonlinear dynamic systems (and appealing to a famous equation from the discipline of physics), as well as focusing on physiological variables and thus appealing to the most scientific-appearing area within the discipline of psychology. This type of spurious work, coming from the researcher positive psychology has lauded as its best of the best, and that has garnered international headlines, is precisely why we included the phrase “wishful thinking” in the title of two of our articles on debunking the critical positivity ratio—and this shoddy work seems not merely anomalous within the subdiscipline but endemic.

Implications for Positive Psychology

This leads us to consider the strong claim that positive psychology replaces humanistic psychology by the former providing the scientific rigor that the latter lacks. Unfortunately, we surmise that, based on this small sample of what has been touted as coming from the best of the best—and is among the most impactful research within positive psychology, this subdiscipline has not cured, but merely repeated, whatever research problems that humanistic psychology might have had with its own romanticism, resulting in what are even more egregious problems that we now call romantic scientism. In contrast to pseudo-profound bullshit consisting of vague statements that sound scientific, romantic scientism could not be more precise, as claims such as 2.9013 being a universal-invariant tipping point, a number specified to 4 places beyond the decimal point and which in fact goes on from there, is as precise as can possibly be, and yet it is a completely bogus number. When Seligman and Csikszentmihalyi (2000) fired their opening salvo proclaiming the alleged scientific advantages of positive psychology over humanistic psychology, they lamented the myriad of therapeutic self-help programs and the proliferation of books that lacked a scholarly standard spawned by humanistic psychology. If they were secretly even a little bit envious of humanistic psychology's commercial success in these areas, perhaps they can now be proud that the critical positivity ratio, and similar bogus research findings, has led to numerous dubious applications and self-help books, signifying that the divide between the two subdisciplines has now undeniably collapsed.

Introducing the Articles in the Special Issue

With that stated, we asked a number of psychologists who, like us, are skeptical of some of the more breathtaking claims of positive psychology to reflect on the meaning of debunking the critical positivity ratio for both positive and

humanistic psychology, especially with some attention to future possible uses of nonlinear dynamic systems and similar mathematical approaches. Their contributions, which form the bulk of this special issue, are briefly described in the following paragraphs. As an overall introductory comment, we want to note the importance of not throwing out the proverbial baby with the bathwater, a metaphor used by Fredrickson (2013b) in discussing our debunking. Merely because the mathematics was misapplied in the case of the critical positivity ratio does not mean that there are no good uses for nonlinear dynamic systems in psychology, including within humanistic psychology.

Grant Rich (2017) argues that a reconciliation between humanistic and positive psychology is possible, and that a key component of this will be an understanding by those who identify with each subfield of each other's research methods. In particular, he argues that positive psychology, now perhaps stepping back from the scientistic brink in the wake of the critical positivity ratio debacle, needs to make more use of qualitative methods. Historically, such methods have been looked down on by many psychologists, who preferred the "objectivity" of quantitative measurements of variables, often involving experimental manipulations. However, the recent "replication crisis" (Earp & Trafimow, 2015; Ioannidis, 2005) affecting many subdisciplines of psychology—perhaps most seriously social psychology, whose research traditions influence much of the empirical research in positive psychology—may provide an opportunity for reflection. At one level, many experimental paradigms have been called into question, which in turn raises doubts about the general validity of such ways of conducting research when the goal is to learn about how humans behave in real-world situations. At another level, increasing recognition of the limitations of underpowered studies (e.g., Simmons, Nelson, & Simonsohn, 2013) show that the reliable identification of effects in laboratory settings typically require larger sample sizes than have hitherto been the norm (Button et al., 2013), considerably increasing the logistical and financial complexity of such research programs. Perhaps qualitative methods, hitherto often thought of as too imprecise or inefficient in their use of the researchers' time, may turn out to be more efficient than was once believed.

Carol Nickerson's article (2017b) discusses the story of the refutation of the critical positivity ratio that has, until now, been focused principally on the article in the *American Psychologist* by Brown et al. (2013). She sees this as understandable, as the more unusual aspects of this story (e.g., the limited academic background of the lead author or the extraordinary nature of the claims that were debunked) have resulted in interesting discussions in the popular media (e.g., Anthony, 2014; Rotondaro, 2013; Wagner, 2015), as well as within academia (e.g., Pérez-Álvarez, 2016). However, behind the

spectacular deterministic assertions about human behavior that were made by Fredrickson and Losada (2005), there remains a more prosaic story of everyday social–psychological research. Nickerson presents a thorough analysis of the entire empirical literature of the critical positivity ratio and concludes that there is simply no evidence to suggest that any particular value resulting from the trivial calculation of the ratio of two numbers, representing in some way a person’s positive and negative emotions, is associated with any psychological outcomes. Nickerson’s article illustrates how easy it is for psychologists—especially those who are convinced that they have identified some fundamental truth about human nature—to misunderstand the meaning of the experimental designs and statistical analyses that they use, to the point where almost anything can become seen as “true.” It also raises questions about the effectiveness of the peer-review process in detecting flawed logic before studies are published. Given the reluctance of “leading” journals to retract, issue corrections for, or even accept critical commentaries on clearly erroneous articles (e.g., Ritchie, Wiseman, & French, 2012), this is a serious concern, especially since positive psychology, in particular, relies heavily on the promotion of its empirical findings via the graduates of Master in Applied Positive Psychology (MAPP) courses, which do not always impose a rigorous requirement to follow critical evaluations of published literature.

In her article, Barbara Held (2017) incisively explores the meaning of the labels “positive” and “negative,” which positive psychologists apply to emotions, character traits, experiences, and psychological interventions. She shows that positive psychology’s *a priori* definition of these labels entails that attempts to demonstrate the effects of positivity empirically are likely to be meaningless. This is because positive emotions (such as joy, gratitude, and hope) are defined as those that are both (a) pleasant to experience and (b) highly likely to produce desirable outcomes in the first place. Thus, Held poses a thorny question for positive psychology: Is the experience of (hedonic) happiness (positivity, etc.) a *component* of (eudaimonic) flourishing, or does it *cause* an independent state of flourishing? Logically, it cannot be both. Indeed, Held’s argument suggests that the two principal overarching theories of positive psychology, Seligman’s (2011) “PERMA” and Fredrickson’s (e.g., 2013a) “Broaden-and-Build,” may turn out to be as fundamentally irreconcilable as general relativity and quantum mechanics.

Finally, David Pincus, Adam Kiefer, and Jessica Beyer (2017) argue that Fredrickson and Losada’s (2005) misapplication of differential equations drawn from fluid mechanics should not obscure the serious work of many scholars who use nonlinear dynamic systems as the most parsimonious models to explain changes in people’s behavior over time. Perhaps the smudged baby that needs to be saved from the dirtied bathwater of the critical positivity

ratio is not, as Fredrickson (2013b) suggested, the various empirical studies that purport to show that some critical relation (whose exact value is no longer specified) between the number of positively and negatively valenced phenomena being experienced predicts human flourishing. Instead, Pincus and colleagues stress that the most important factor in the production of replicable, incremental science is to respect the basic principles of research. If an adequate theoretical background and precise hypotheses are present, the methods used will stand or fall on their ability to explain observed reality. In the absence of these prerequisites, however, any method will do, especially if the prevailing publishing system rewards the production of “interesting” noise.

Conclusion

Ioannidis (2005) shocked the scientific world when he published a seminal article claiming that most research findings are false. Positive psychology has staked its reputation on attacking humanistic psychology for its supposed scientific inadequacies while touting its superiority in bringing scientific rigor into research areas long explored by humanistic psychologists, and our debunking work has demonstrated that such pride is premature. The supporting work on the critical positivity ratio adds to the litany of false research findings, and we believe the progress of science relies on the interplay of removing the detritus of false claims, while doing the good science that builds solid evidence.

The full impact of the disaster known as the critical positivity ratio has still not sufficiently defused throughout the positive psychology community or the wider world, but our hope is it will lead to a greater humility within adherents to positive psychology, so they might gain more appreciation for their own subdiscipline’s limitations by avoiding outrageous claims in the future, and also they begin to recognize better the many important contributions from humanistic psychology that are amply supported by scientific research (such as in psychotherapy research; see Friedman, 2016). Such discernment is sorely needed within positive psychology, and this need is slowly beginning to be addressed by more critical approaches to that subdiscipline (e.g., Brown, Lomas, & Eiroa-Orosa, 2017). Prior to our debunking work, Schneider (2011) used the critical positivity ratio as an example of serious conceptual limitations in positive psychology. We have gone beyond this to demonstrate that the critical positivity ratio is bunk through and through, and that similar reductionistic ratios cannot be defended as anything more than methodological artifacts contingent only on the way measures are taken. The yearning within positive psychology to find such magical ratios is romantically appealing, and bolstering these efforts using

scientific approaches surely amounts to romantic scientism. Schneider made an impassioned plea for developing an integrated humanistic–positive psychology in which both humanistic and positive psychology might get along cooperatively as sibling subdisciplines rather than as competing factions, as did Friedman (2008, 2013a, 2013b, 2014) in a number of publications. The articles in this special issue address this possibility for reconciliation and also show how responsible approaches to using nonlinear dynamic systems can be appropriately incorporated into humanistic psychology, as well as how positive psychology can avoid future blunders involving advocating for bogus findings such as the critical positivity ratio. Science is a self-correcting endeavor, and our hope is that positive psychologists will see this baby's smudge (again using the metaphor employed by Fredrickson, 2013a) as a learning experience, rather than an affront, as both subdisciplines have much good yet to accomplish in the world; but it takes humility (Leary et al., 2017), and perhaps even heroic courage (Friedman, 2017), to honestly admit and learn from painful mistakes.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding


The author(s) received no financial support for the research, authorship, and/or publication of this article.

Notes

1. See Brown (2014) for a discussion of the extent to which this program, billed by its initiators as “training,” is difficult to distinguish from a research undertaking.
2. This term does not refer to *Vodun/Vodou* as a respected world religion but, rather, is used in line with how others have employed this term to describe a type of bad science, such as in the infamous title of a prominent paper (Vul, Harris, Winkielman, & Pashler, 2009), originally published under the title of “Voodoo Correlations in Social Neuroscience,” but later having its title changed at the editor's request to “Puzzlingly high correlations in fMRI studies of emotion, personality, and social cognition” post publication (see <http://www.edvul.com/voodoo CORR.php>). Note that some of the discussion here related to voodoo science is taken from an unpublished privately circulated newsletter article (Friedman, 2015b).
3. Specifically, a press release (Wheeler, 2013) promoting this study implied that people who score more highly on eudaimonic well-being typically have immune systems primed to ward off the viruses they will be catching from their large

number of friends, whereas people with a preponderance of hedonic well-being have gene expression profiles consistent with fighting off the bacterial infections that they are likely to experience due to all the fights they are probably going to get into.

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